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ENERGY ENGINEERING ANALYSIS PROGRAM
FORT POLK , LOUISIANA

FINAL
EXECUTIVE SUMMARY
INCREMENT ' F '

DTIC QUALITY INSPECTED 2

PREPARED FOR

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
FORT WORTH DISTRICT
FORT WORTH, TEXAS

CONTRACT NO. DACA63-84-D-0056

PREPARED BY

GRAHAM AND ASSOCIATES
PROFESSIONAL CONSULTING ENGINEERS INC.
OKLAHOMA CITY, OKLAHOMA

JUNE 1988

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DEPARTMENT OF THE ARMY
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1. INTRODUCTION

1.1 General

Executive Order 12003, dated 19 July 1977, initiated the U.S. Army's energy conservation effort. Specifically, the Executive Order led to the development of the Army Facilities Energy Plan which directs Army Staff and Major Army Commands to develop detailed implementation plans for energy conservation. As a result of these directives, the Fort Worth District of the U.S. Army Corps of Engineers contracted for an Energy Engineering Analysis Program (EEAP) at Fort Polk, Louisiana. The EEAP included Increments "A", "B", "E", and "G".

1.2 Authority

In an effort to complete all increments of the EEAP, Ft. Worth District contracted Graham & Associates Professional Consulting Engineers to conduct Increment "F" under Contract No. DACA63-84-0056, Delivery Order No. 5. The Contract included an "Increment "F" General Scope of Work for FORSCOM Installations", dated 10 May 1983, and a "Detailed Scope of Work" furnished with Delivery Order No. 5, dated 27 September 1984. The Scope of Work is included in Section 7 of the main report.

1.3 Analysis Methodolgy

To accomplish the intent of Increment "F", namely, providing low cost/no cost energy savings recommendations in the form of specific, practical instructions for use by the Facility Engineer, the following general steps were taken:

1. Consider measures identified in Detailed Scope of Work.
2. Identify other potential Low Cost/No Cost Energy Conservation Measures (ECM) through discussions with Fort Polk personnel and field surveys by Graham & Associates engineers.
3. Review Increments "A", "B", and "G" for ECM's within the Facility Engineer's funding authority; \$200,000 for alteration projects and \$1,000,000 for maintenance and repair type work.
4. Evaluate ECM's using relevant data for other Increments of the EEAP, and develop new data where appropriate.

1.4 Progress

Overall progress of the Increment "F" work by EEAP phases is:

<u>EEAP PHASE</u>	<u>PERCENT COMPLETE</u>
I. Data Gathering	100%
II. Data Analysis/Project Evaluation	100%
III. Programming Documents	100%

1.5 Overview

The Increment "F" report presents an analysis of proposed Energy Conservation Measures (ECM) based on a review of previous documents and extensive field survey. Each proposed ECM analysis is presented in Section 4 of the Increment "F" Final Report in the following manner:

ECM Number and Title: A brief title of the proposed measure.
The number is provided for a quick reference.

I. Reason For Energy Conserving Modification.

Description of why the modification was proposed.

II. Accomplishing Energy Conserving Modification.

Synopsis of how to accomplish the proposed ECM.

III. Estimated Man-Hours, Labor, and Material Costs.

1. Labor man-hours estimated by trade.

2. Material and labor costs estimated for calendar year 1986.

IV. Estimated Energy Savings.

Theory and technique used are documented with demonstration calculations. Other results are presented in a tabular form.

V. Economic Analysis.

Analysis performed in accordance with Energy Conservation Investment Program (ECIP) Guidance dated 10 August 1982 and revised 15 February 1985.

Section 5 of the Increment "F" Final Report presents tabular data summarizing the results Energy Conservation Measures from Increments "A", "B", "F" and "G" in order of decreasing SIR value. Also presented in the

summary tables are increment "F" projects that qualify for "PIF", "QRIP" or "Low-Cost" funding. These summaries coupled with the energy impact of the Master Plan changes, as presented in Section 4.2 of the Final Report, show the possibilities available to meet energy reduction goals.

2.0 Existing Energy Consumption

From data presented by CRS Group, Inc. overall energy consumption in FY-83 at Ft. Polk is:

<u>FUEL</u>	<u>UNIT</u>	<u>SOURCE ENERGY</u>	<u>COST</u>
Electricity	KWH	1,709,585 MBTU	\$6.7 Million
Natural Gas	MCF	642,245 MBTU	\$3.1 Million
<u>Totals</u>		<u>2,351,830 MBTU</u>	<u>\$9.8 Million</u>

The use of other liquid petroleum products in FY-83 is shown as follows:

JP-4 (aviation turbine fuel):	60,000 MBTU's
Motor gasoline:	130,000 MBTU's
Diesel fuel:	180,000 MBTU's
Aviation gas:	200 MBTU's

Energy consumption at Ft. Polk has increased significantly in the last ten years. Primarily due to more buildings being air conditioned than before. Wise management of available funds to purchase energy conservative products and equipment will help hold down the dramatic growth of energy consumption.

3.0 Energy Conservation Measures Developed:

Twenty eight Energy Conserving Measures (ECM's) were investigated for implementation at Fort Polk, Louisiana for Increment "F". Several ECM's are for typical systems which may find more application than indicated by this Report.

3.1 ECM Summary, Results

A summary of each Energy Saving Measure (ECM) Funding Category (QRIP, PIF, LC/NC) is presented in Tables ES-1, ES-2, and ES-3. Each table includes a brief description of the ECM, Energy Savings Project Cost, SIR, and Simple Payback.

ECM's presented in Table ES-4 proved to be not fundable as QRIP, PECIP or Low Cost/No Cost, and did not meet ECIP criteria. These projects are listed only for continuity with the total project scope. Table ES-5 presents a summary of Increment "F" projects listed by SIR ranking, Table ES-6 lists synergistic ECM's by SIR ranking and Table ES-7 is synergistic ECM's by ECM number.

A summary of recommended ECM's is presented in Table ES-6. This table shows costs and savings if all recommended ECM's are implemented.

TABLE ES-1 INCREMENT 'F' ECM SUMMARY
ORIP PROJECTS

ECM NO.	ECM DESCRIPTION	ENERGY SAVED (MBTU/YR)		ENERGY SAVINGS (1985 \$/YR)		PROJECT COST (1985 \$)	STR	SIMPLE PAY			LABOR REQUIRED (MAN-HOURS)				
		N. GAS	ELECT.	N. GAS	ELECT.			BACK	PLB	SMW	STF	ELT	OST	LAB	
14	SET-BACK THERMOSTATS-171XX	7018.0		\$27441.00		\$6780.00	54.85	0.25							
4	SET-BACK THERMOSTATS-610XX	14943.0		\$58426.00		\$14560.00	54.02	0.25							
5	EMCS - 1733	0.0	917.0	\$0.00	\$15743.00	\$15318.00	6.90	1.55							
28	ECMS - COMBINATION #1733 & #7678	13.4	1204.0	\$52.00	\$20661.00	\$40315.00	3.44	1.95							
XXX TABLE TOTALS --->															
		21974.4	2121.0	\$85919.00	\$36404.00	\$76954.00	XXXXX	XXXXXX	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PLB = PLUMBER; SMW = SHEETMETAL WORKER; STF = STEAM FITTER; ELT = ELECTRICIAN; OST = OTHER SKILLED TRADES; LAB = COMMON LABORER

NOTE: ECM-5 WILL NOT BE DONE IF ECM-28 IS INSTALLED.

TABLE ES-2 INCREMENT 'F' PIF PROJECT SUMMARY

EQUIP. NO.	EQUIP DESCRIPTION	ENERGY SAVED (MBtu/yr)		ENERGY SAVINGS (1986 \$/yr)		PROJECT COST	LABOR REQUIRED (MAN-HOURS)						SIMPLE PAY		REMARKS
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SMW	STF	ELT	OST	LAB	SIR	BACK	
	25 WOOD FUEL BOILER	24300.0		\$62937.00		\$126000.00	500	1000	1000	500	1000		4.43	3.42	PIF PROJECT
	XXX PAGE TOTALS >>	24300.0	0.0	\$62937.00	\$0.00	\$126000.00	500	0	1000	500	1000	0	XXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXX

COAL SAVINGS SHOWN UNDER N. GAS.

PLB = PLUMBER, SMW = SHEETMETAL WORKER, STF = STEAM FITTER, ELT = ELECTRICIAN, OST = OTHER SKILLED TRADES, LAB = COMMON LABORER

TABLE ES-3 INCREMENT 'F' EDM SUMMARY
LOW COST PROJECTS

EDM NO.	EDM DESCRIPTION	ENERGY SAVED (MMBtu/yr)		ENERGY SAVINGS (1986 \$/yr)		PROJECT COST (1986 \$)	LABOR REQUIRED (MAN-HOURS)					SIMPLE PAY		REMARKS
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SMW	STF	ELT	OST	LAB	SIP	
1	REZONE BLDG 417	34.0	30.0	\$133.00	\$515.00	\$1446.00			8	12			4.82	2.24 LOW-COST
2	ROOF BATT INSULATION-610XX	314.5	431.7	\$1230.00	\$7408.00	\$45231.00					578		2.75	5.25 LOW-COST
7	CHILLER SET-BACK BLDG 1052		3.0		\$54.00	\$181.00				4			6.27	1.52 LOW-COST
8	CONTROL EXTERIOR LTS/MOTOR POOLS		41.0		\$704.00	\$1092.00				18			9.15	1.47 LOW-COST
9	RADIANT HEATERS	433.0		\$1693.00		\$11018.00							3.16	6.53 LOW-COST
12	ROOF INSULATION-171XX	82.0	43.0	\$319.00	\$736.00	\$8164.00					80		2.01	7.76 LOW-COST
15	EMCS-7679	13.0	287.0	\$53.00	\$4920.00	\$25000.00							1.72	6.01 LOW-COST
19	URETHANE INSULAT. SOH A-ROOF 1	13.0	5.0	\$52.00	\$85.00	\$1450.00							1.08	10.62 LOW-COST
20	RPL INC TO PPS		152.0		\$2608.00	\$30355.00							1.00	11.42 LOW-COST
21	REPLACE STAIRWELL LAMPS W/ FLUOR		4.6		\$82.00	\$1071.00							2.73	4.48 LOW-COST
21	REPLACE STAIR LAMPS W/ FLUOR FIX		4.3		\$73.00	\$1344.00				27			2.09	5.84 LOW-COST
22	HEAT EXCH INSUL-TWO INCH	11.0		\$44.00	\$540.00	\$540.00							1.68	12.27 LOW-COST
22	HEAT EXCH INSUL-ONE-HALF INCH	10.0		\$40.00	\$493.00	\$493.00							1.66	12.42 LOW-COST
22	HEAT EXCH INSUL-ONE INCH	9.0		\$33.00	\$420.00	\$420.00							1.63	12.67 LOW-COST
25	SOLAR HEAT POOL 272	579.0		\$6173.00		\$50972.00					60		2.49	8.23 LOW-COST
23	SOLAR HEAT POOL 1459	832.0		\$3253.00		\$30380.00					30		2.20	9.37 LOW-COST
23	POOL COVER 272	425.0		\$1662.00		\$9565.00							1.59	5.78 LOW-COST
23	POOL COVER 1459	211.0		\$825.00		\$4752.00							1.59	5.78 LOW-COST
XXX	PAGE TOTALS	3966.5	1001.7	\$15510.00	\$17185.00	\$273474.00	0	0	8	61	748	0	XXXXX	XXXXXXXXXXXXXXXXXXXX

COAL SAVINGS 9-TON UNDER N. GAS.

TABLE ES-4 INCREMENT 'F' NON QUALIFYING EOM SUMMARY BY EOM NO.

EOM NO.	EOM DESCRIPTION	ENERGY SAVED (MBtu/YR)		ENERGY SAVINGS (1986 \$/YR)		PROJECT COST (1986 \$)	LABOR REQUIRED (MAN-HOURS)				SIMPLE PAV		REMARKS		
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SNW	STF	ELT	OST	LAB		SIR	BACK
3	D-WT INSULATION-610XX														REFER TO EOM-3 REPORT
5	BACS-1715	4.0	87.0	\$16.00	\$1496.00	\$15319.00							0.69	15.20	NQ
5	BACS-1701		85.0		\$1458.00	\$15319.00							0.61	17.50	NQ
5	BACS-317		204.0		\$3501.00	\$15319.00							-1.83	-4.41	NQ
6	POINT OF USE HT WTR-610XX	4.2	-7.3	\$16.50	(\$12.40)	\$343.00							0.28	83.90	NQ
10	ALTERNATE TRANSPORTATION														REFER TO EOM-10 REPORT
11	RADIO DISPATCH MAINT VEHICLES														REFER TO EOM-11 REPORT
13	D-WT INSULATION-171XX														REFER TO EOM-13 REPORT
15	BACS-7419	7.0	113.0	\$28.00	\$1932.00	\$15319.00							0.95	11.18	NQ
15	BACS-7401	7.0	108.0	\$28.00	\$1850.00	\$15319.00							0.89	11.99	NQ
15	BACS-7420	4.0	84.0	\$16.00	\$1444.00	\$15319.00							0.62	17.46	NQ
15	BACS-7801		38.0		\$656.00	\$25000.00							0.04	796.10	NQ
16	POINT OF USE HT WTR-171XX	3.3	-0.3	\$12.71	(\$5.87)	\$343.00							0.33	50.30	NQ
17	VAV CONVERSION	40.8	54.7	\$160.00	\$939.00	\$16689.00							0.69	15.15	NQ
18	REFLECT ROOF COAT, SOH A-ROOF 1	-4.0	2.4	(\$15.00)	\$41.00	\$297.00							0.35	11.73	NQ
18	REFLECT ROOF COAT, SOH C-ROOF 1	-3.9	2.0	(\$15.00)	\$34.00	\$297.00							0.26	15.65	NQ
18	REFLECT ROOF COAT, SOH C-ROOF 2	-4.0	0.4	(\$15.00)	\$6.00	\$297.00							0.15	-32.90	NQ
18	REFLECT ROOF COAT, SOH A-ROOF 2	-0.7	0.4	(\$3.00)	\$8.00	\$297.00							0.07	63.45	NQ
19	URETHANE INSULAT, SOH A-ROOF 2	1.0	1.0	\$4.00	\$7.00	\$1450.00							0.09	132.30	NQ
20	RPL INC TO LPS		175.0		\$2896.00	\$147561.00							0.60	20.77	NQ
20	RPL MW TO LPS		3.0		\$46.00	\$984.00							0.53	26.53	NQ
20	RPL MW TO HPS		2.0		\$34.00	\$536.00							0.13	1525.60	NQ
24	USE EXCESS STEAM TO GENER ELEC														REFER TO EOM-24 REPORT
26	GROUND WATER TO CONDENSERS		542.0		\$9294.00	\$2941490.00							0.03	317.00	NQ
27	SOLAR SCREEN		13.0		\$223.00	\$12000.00							0.25	53.94	NQ
XXX PAGE TOTALS ==>		58.6	1507.3	\$233.21	\$25946.73	\$3236398.00	0	0	0	0	0	0	XXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXX

COAL SAVINGS SHOWN UNDER N. GAS.

TABLE ES-5 INCREMENT 'F' EOM SUMMARY BY SIR RANK

EOM NO.	EOM DESCRIPTION	ENERGY SAVED (MBTU/YR)		ENERGY SAVINGS (1986 \$/YR)		PROJECT COST	LABOR REQUIRED (MAN/OURS)					SIR	SIMPLE PAY		REMARKS
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SNW	STF	ELT	OST	LAB	BACK	PAY	
14	SET-BACK THERMOSTATS-171XX	7018.0		\$27441.00		\$6760.00		52					0.25		ORIP
14	SET-BACK THERMOSTATS-610XX	14843.0		\$58426.00		\$14560.00		112					0.25		ORIP
4	CONTROL EXTERIOR LITS/MOTOR POOLS					\$1092.00			18				1.47		ORIP
5	EMCS-1733		41.0	\$15743.00		\$15319.00							1.55		LOW-COST
7	CHILLER SET-BACK BLDG 1052		917.0	\$54.00		\$181.00							1.52		LOW-COST
1	REZONE BLDG 417		30.0	\$515.00		\$1446.00			4				2.24		PIF
25	WOOD FUEL BOILER	34.0		\$133.00		\$126000.00	500		8	12	1000	225	3.42		ORIP
28	COMBINATION 5(1733) & 15(7679)	24300.0		\$62937.00		\$40315.00							3.44		LOW-COST
9	RADIANT HEATERS	13.4		\$1693.00		\$11018.00							3.16		LOW-COST
2	ROOF BATT INSULATION-610XX	433.0		\$52.00		\$45231.00					579		2.75		LOW-COST
21	REPLACE STAIRWELL LAMPS W/ FLUOR	314.5		\$1230.00		\$7408.00					60		2.73		LOW-COST
23	SOLAR HEAT POOL 272		431.7	\$6173.00		\$82.00					30		2.49		LOW-COST
23	SOLAR HEAT POOL 1459	1578.0		\$3253.00		\$30380.00					27		2.20		LOW-COST
21	REPLACE STAIR LAMPS W/ FLUOR FIX	832.0		\$319.00		\$1344.00					80		2.09		LOW-COST
12	ROOF INSULATION-171XX		4.3	\$53.00		\$8164.00							2.01		LOW-COST
15	EMCS-7679	82.0	43.0	\$44.00		\$540.00							1.72		LOW-COST
22	HEAT EXCH INSUL-TWO INCH	13.0	287.0	\$33.00		\$9565.00							1.68		LOW-COST
22	HEAT EXCH INSUL-ONE HALF INCH	11.0		\$40.00		\$4752.00							1.66		LOW-COST
22	HEAT EXCH INSUL-ONE INCH	10.0		\$33.00		\$420.00							1.63		LOW-COST
22	POOL COVER 272	9.0		\$1662.00		\$825.00							1.59		LOW-COST
23	POOL COVER 1459	425.0		\$825.00		\$85.00							1.58		LOW-COST
23	URETHANE INSULAT, SO1 A-ROOF 1	211.0		\$52.00		\$1450.00							1.08		LOW-COST
19	RPL INC TO HPS	13.0	5.0	\$28.00		\$80355.00							0.95		NQ
20	EMCS-7419	7.0	152.0	\$28.00		\$15319.00							0.89		NQ
15	EMCS-7401	113.0	108.0	\$1850.00		\$15319.00							0.89		NQ
15	EMCS-1715	7.0	87.0	\$16.00		\$1486.00							0.89		NQ
5	VAV CONVERSION	4.0	54.7	\$160.00		\$1444.00							0.62		NQ
17	EMCS-7420	40.8	84.0	\$1458.00		\$15319.00							0.61		NQ
15	EMCS-1701	4.0	85.0	\$2996.00		\$147561.00							0.60		NQ
5	RPL INC TO LPS		175.0	\$46.00		\$984.00							0.53		NQ
20	REFLECT ROOF COAT, SO1 A-ROOF 1	-4.0	3.0	\$41.00		\$297.00							0.35		NQ
18	POINT OF USE HT WTR-171XX	3.3	2.4	\$12.71		\$343.00							0.33		NQ
16	POINT OF USE HT WTR-610XX	3.3	-0.3	\$16.50		\$343.00							0.28		NQ
6	POINT OF USE HT WTR-610XX	4.2	-7.3	\$34.00		\$297.00							0.26		NQ
18	REFLECT ROOF COAT, SO1 C-ROOF 1	-3.9	2.0	\$223.00		\$12000.00							0.25		NQ
27	SOLAR SCREEN		13.0	\$6.00		\$297.00							0.15		NQ
18	REFLECT ROOF COAT, SO1 C-ROOF 2	-4.0	0.4	\$34.00		\$536.00							0.13		NQ
20	RPL MV TO HPS		2.0	\$7.00		\$1450.00							0.09		NQ
19	URETHANE INSULAT, SO1 A-ROOF 2	1.0	1.0	\$8.00		\$297.00							0.07		NQ
18	REFLECT ROOF COAT, SO1 A-ROOF 2	-0.7	0.4	\$656.00		\$25000.00							0.04		NQ
15	GROUND WATER TO CONDENSERS		38.0	\$9294.00		\$2941490.00							0.03		NQ
26	EMCS-7801		542.0	\$3501.00		\$15319.00							-1.83		NQ
5	EMCS-317		204.0												REFER TO EOM-11 REPORT
11	RADIO DISPATCH MAINT VEHICLES														REFER TO EOM-3 REPORT
3	DWT INSULATION-610XX														REFER TO EOM-10 REPORT
10	ALTERNATE TRANSPORTATION														REFER TO EOM-13 REPORT
13	DWH INSULATION-171XX														REFER TO EOM-24 REPORT
24	USE EXCESS STEAM TO GENER ELEC														
XXX	PAGE TOTALS =>	50298.5	4630.0	\$164599.21	\$79535.73	\$3715826.00	500	164	1008	561	1824	225	XXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXX

COAL SAVINGS \$/DWN UNDER N. GAS.

TABLE ES-6 RECOMMENDED INCREMENT 'F' SYNERGISTIC EOM'S
SUMMARY BY SIR RANKING

EOM NO.	EOM DESCRIPTION	ENERGY SAVED (MMBtu/yr)		ENERGY SAVINGS (1986 \$/yr)		PROJECT COST	LABOR REQUIRED (MAN-OURS)					SIMPLE PAV		REMARKS
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SNW	STF	ELT	OST	LAB	SIR	
14	SET-BACK THERMOSTATS-171XX	7018.0		\$27441.00		\$6760.00		52					54.65	ORIP
4	SET-BACK THERMOSTATS-610XX	14943.0		\$58426.00		\$14560.00		112					54.02	ORIP
8	CONTROL EXTERIOR LTS/MOTOR POOLS		41.0		\$704.00	\$1092.00				18			9.15	LOW-COST
7	CHILLER SET-BACK BLDG 105.2		3.0		\$54.00	\$181.00				4			6.27	LOW-COST
5	REZONE BLDG 417	34.0	30.0	\$133.00	\$515.00	\$1446.00				12			4.82	LOW-COST
25	WHD FUEL BOILER	24300.0		\$62937.00		\$126000.00	500		1000	500	1000		4.43	PIF
26	COMBINATION 5(1733) & 15(7679)	13.4	1204.0	\$52.00	\$20661.00	\$40315.00						225	3.44	ORIP
9	RADIANT HEATERS	432.0		\$1683.00		\$11018.00							3.16	LOW-COST
2	ROOF BATT INSULATION-610XX	314.5	431.7	\$1230.00	\$7408.00	\$45231.00					579		2.75	LOW-COST
21	REPLACE STAIRWELL LAMPS W/ FLUOR		4.6		\$82.00	\$1071.00							2.73	LOW-COST
23	SOLAR HEAT POOL 272	1578.0		\$6173.00		\$50972.00							2.49	LOW-COST
23	SOLAR HEAT POOL 1459	832.0		\$3253.00		\$30380.00					60		2.20	LOW-COST
21	REPLACE STAIR LAMPS W/ FLUR FIX		4.3		\$73.00	\$1344.00				27			2.08	LOW-COST
12	ROOF INSULATION-171XX	82.0	43.0	\$319.00	\$736.00	\$8164.00					80		2.01	LOW-COST
22	HEAT EXCH INSUL-TWO INCH	11.0		\$44.00		\$540.00							1.68	LOW-COST
22	HEAT EXCH INSUL-ONE/HLF INCH	10.0		\$40.00		\$493.00							1.66	LOW-COST
22	HEAT EXCH INSUL-ONE INCH	9.0		\$33.00		\$420.00							1.63	LOW-COST
23	POOL COVER 272	425.0		\$1662.00		\$9565.00							1.59	LOW-COST
23	POOL COVER 1459	211.0		\$826.00		\$4752.00							1.59	LOW-COST
20	RPL INC TO FPS		152.0		\$2608.00	\$80355.00							1.08	LOW-COST
19	URETHANE INSULAT. SOH A-ROOF 1	13.0	5.0	\$52.00	\$85.00	\$1450.00							1.08	LOW-COST
XXX	PAGE TOTALS =>	50227.9	1918.7	\$164313.00	\$32926.00	\$436109.00	500	164	1008	561	1749	225	XXXXX	XXXXXXXXXXXXXXXXXXXX

COAL SAVINGS \$YDWN UNDER N. GAS.

TABLE ES-7 RECOMMENDED INCREMENTAL SYNERGISTIC EOM'S
SUMMARY BY EOM NO.

EOM NO.	EOM DESCRIPTION	ENERGY SAVED (MMBtu/YR)		ENERGY SAVINGS (1986 \$/YR)		PROJECT COST (1986 \$)	LABOR REQUIRED (MAN-OURS)					SIMPLE PAY		REMARKS	
		N. GAS	ELECT.	N. GAS	ELECT.		PLB	SMW	STF	ELT	OST	LAB	SIR		BACK
1	REZONE BLDG 417	34.0	30.0	\$133.00	\$515.00	\$1446.00			8	12			4.82	2.24	LOW-COST
2	ROOF BATT INSULATION-610XX	314.5	431.7	\$1230.00	\$7408.00	\$45231.00					579		2.75	5.25	LOW-COST
4	SET-BACK THERMOSTATS-610XX	14943.0		\$58426.00		\$14560.00		112					54.02	0.25	ORIP
7	CHILLER SET-BACK BLDG 1052		3.0		\$54.00	\$181.00				4			6.27	1.52	LOW-COST
8	CONTROL EXTERIOR LTS/MOTOR POOLS		41.0		\$704.00	\$1092.00				18			9.15	1.47	LOW-COST
9	RADIANT HEATERS	433.0		\$1683.00		\$11018.00							3.16	6.53	LOW-COST
12	ROOF INSULATION-171XX	82.0	43.0	\$319.00	\$736.00	\$8164.00					80		2.01	7.76	LOW-COST
14	SET-BACK THERMOSTATS-171XX	7018.0		\$27441.00		\$6760.00		52					54.65	0.25	ORIP
18	URETHANE INSULAT., SCH A-ROOF 1	13.0	5.0	\$52.00	\$85.00	\$1450.00							1.08	10.62	LOW-COST
20	RPL INC TO HPS		152.0		\$2608.00	\$80355.00							1.08	11.42	LOW-COST
21	REPLACE STAIRWELL LAMPS W/ FLUOR		4.8		\$82.00	\$1071.00							2.73	4.48	LOW-COST
21	REPLACE STAIR LAMPS W/ FLUR FIX		4.3		\$73.00	\$1344.00				27			2.08	5.84	LOW-COST
22	HEAT EXCH INSUL-TWO INCH	11.0		\$44.00		\$540.00							1.68	12.27	LOW-COST
22	HEAT EXCH INSUL-ONE HALF INCH	10.0		\$40.00		\$493.00							1.66	12.42	LOW-COST
22	HEAT EXCH INSUL-ONE INCH	9.0		\$33.00		\$420.00							1.63	12.67	LOW-COST
23	SOLAR HEAT POOL 272	1579.0		\$6173.00		\$50972.00					60		2.49	8.23	LOW-COST
23	SOLAR HEAT POOL 1459	832.0		\$3253.00		\$30380.00					30		2.20	9.37	LOW-COST
23	POOL COVER 272	425.0		\$1662.00		\$9565.00							1.59	5.78	LOW-COST
23	POOL COVER 1459	211.0		\$825.00		\$4752.00							1.59	5.78	LOW-COST
25	WOOD FUEL BOILER	24300.0		\$62937.00		\$126000.00			1000	500	1000		4.43	3.42	PIF
28	COMBINATION 5(1733) & 15(17678)	13.4	1204.0	\$52.00	\$20661.00	\$40315.00						225	3.44	1.95	ORIP
XXX	PAGE TOTALS ==>	50227.8	1918.7	\$164313.00	\$32926.00	\$436109.00	500	164	1008	561	1749	225	XXXXX	XXXXXX	XXXXXXXXXXXXXXXXXXXX

COAL SAVINGS 9.0MM UNDER N. GAS.

3.2 ECM Conclusions & Recommendations:

- ECM-1: Rezone HVAC system in Building 427 to separate the Chapel from other areas of the building.

This project is recommended as a Low Cost project. Shutting off the heating and cooling during the unoccupied periods will save a great deal of energy.

- ECM-2: Upgrade roof insulation by using interior batts on administrative buildings in Use Categories 610XX.

This project is recommended as a Low Cost project.

- ECM-3: Add insulation to domestic hot water tanks in administrative buildings in Use Categories 610XX.

Increment "A" Analysis indicates this ECM has SIR less than 1.0. This project is not recommended.

- ECM-4: Use automatic set-back thermostats in administrative buildings in Use Categories 610XX.

If an overall "EMCS" system is used, the installation of "Automatic set-back" thermostats is redundant and not recommended. However, since the installation of an "EMCS" system may be years away for these buildings this analysis recommends installing "automatic Set-Back" thermostats, as a QRIP Project.

- ECM-5: Provide ECMS to administrative buildings in Use Categories 610XX.

Of the buildings considered, four qualified for analysis. Building #1733 proved to be eligible for funding. It is recommended as a QRIP project.

A large portion of the savings are due to enthalpy controlled economizers (free cooling cycle) which are controlled by the central computer.

- ECM-6: Use point-of-use hot water heaters instead of centralized storage tank hot water heaters in administrative buildings in Use Categories 610XX.

Thirty two buildings were considered in this analysis. The relatively inexpensive cost of gas vs. electricity makes it hard to justify replacing gas water heaters with electric water heaters. None of the buildings in this category qualified.

- ECM-7: Provide remote automatic set-back of chillers in Barracks Building 1052 by using FM control.

This project uses existing FM broadcast system, and simply adds control devices to an existing chiller. It is recommend this work as a Low Cost project.

- ECM-8: Control exterior lighting in the following Motor Pool Blocks:

<u>No. of</u> <u>M.P.</u>	<u>Block</u> <u>No.</u>	<u>No. of</u> <u>M.P.</u>	<u>Block</u> <u>No.</u>	<u>No. of</u> <u>M.P.</u>	<u>Block</u> <u>No.</u>
4	2700	1	3400	1	4200
1	2800	1	3500	1	4300
2	3000	1	3600	1	4500
1	3100	1	3700	2	4600
1	3200	2	3800	2	4700

This work is recommended as a Low Cost project.

- ECM-9: Use radiant heaters instead of unit heaters in Motor Repair Shops 2750, 2751, 2766, 2774, 2850, 3003, 3020, 3120, 3802, 3810, 3814, 3824, 3830, 4202, 4203, 4350, 4354, 4531, 4533, 4537, 4541, 4640, 4642, 4760 and 4770.

Direct fired gas radiant heaters save energy and warm people and objects better than steam warm air unit heaters. This work is recommended for each building's garage as a replacement for the existing steam heaters in the garage only. Steam units will remain in offices and other areas not suitable for a radiant heater system.

Infrared heaters are not recommended in areas where there is a combustible atmosphere, such as the vapors of motor fuel, or in the presence of vapors that become toxic in contact with a flame. Trichloroethylene, a commonly used degreasing agent, is broken down by combustion into phosgene gas and hydrogen chloride, a poisonous gas and a corrosive gas respectively.

If the possibility of explosive concentrations of fuel or cleaning vapors exist, the use of these heaters is not recommended. However, they have been proven to be effective "spot" heaters when the safety aspect is carefully considered and adequate safety precautions have been taken.

While the costs and savings presented are for Building #3020 only. This analysis applies to similar buildings. Meeting the safety requirements.

- ECM-10: Use alternative type vehicular transportation for shop to job site travel.

This item was not studied per direction of Mr. Morrow. Refer to Section 4, ECM write-up.

- ECM-11: Use radio dispatched maintenance vehicles and equipment.

Per Mr. Jean, this project was incorporated into a "D.I.N." program. Refer to Section 4 ECM write-up.

- ECM-12: Upgrade roof insulation by using interior batts on Flight Trainer and Simulator Buildings Use Category 171XX.

This work saves energy and improves comfort levels. This work is recommended as a Low Cost project.

- ECM-13: Add insulation to domestic hot water tanks in Flight Trainer and Simulator Buildings in Use Categories 171XX.

Per Increment "A" work, this project is not justified, with SIR = .54. Refer to Section 4 ECM write-up.

- ECM-14: Use automatic set-back thermostats in Flight Trainer and Simulator Buildings in Use Categories 171XX.

If an overall "EMCS" system is used, the installation of "Automatic Set-Back" thermostats is redundant and not recommended. However, since the installation of an "EMCS" system may be years away for these buildings this analysis recommends installing "Automatic Set-Back" thermostats, as a QRIP Project.

- ECM-15: Provide ECMS to Flight Trainer and Simulator Buildings in use Categories 171XX.

Of the buildings considered 5 qualified for analysis.

Building #7679 was the only building which proved to be eligible for funding. It is recommended as a Low Cost project.

- ECM-16: Use point-of-use hot water heaters instead of centralized storage tank hot water heaters in Flight Trainer and Simulator Buildings in Use Categories 171XX.

As discussed in EMC-6, replacement of gas heater with electric heater is difficult to justify considering the relatively inexpensive cost of gas vs. electricity. This work has a SIR of .33, and is not recommended for funding.

- ECM-17: Convert existing HVAC system in Dental Clinics, Buildings 1561 and 8001, to variable air volume.

The very high construction costs of this project cause economic analysis to fail, SIR = 0.69. Variable air volume systems work very well, but in this case are not recommended.

- ECM-18: Add reflective coating to existing roofs at time of repair.

In each case studied, SIR is less than 1.0, and is therefore not recommended. Refer to Section 4 - ECM write-up.

- ECM-19: Add urethane insulation base to existing roofs at time of repair.

Of the various schedules considered, only the buildings with little existing insulation and 24 hour per day occupancy proved to be justified. This schedule is recommended based on a 1000 S.F. typical situation.

- ECM-20: Use more efficient lighting sources for street lighting.

This ECM studied various high output lighting sources, and found changing from incandescent to high pressure sodium to be the only feasible choice. This work is recommended as a Low Cost project.

- ECM-21: Replace existing lighting and controls in exterior stairs of permanent barracks buildings.

Consideration was made to replace incandescent light source with (1) new fluorescent fixtures or (2) new fluorescent lamps only. In both cases motion detectors were added. Replacement of lamps and fixtures is recommended, because it will change the lighting level the least.

- ECM-22: Add insulation to heat exchangers of permanent barracks.

This analysis considered adding 1", 1-1/2" and 2" of external insulation to one existing insulated heat exchanger. All three conditions meet funding criteria. The 2" F6 insulation is recommended, as it indicates the highest SIR. This project saves energy and improves comfort levels in the mechanical rooms during hot summer weather.

- ECM-23: Heat Swimming Pools, numbers 272 and 1459, using solar energy with a gas fired heater as back-up. Pool covers are also studied.

Outdoor pools require heating during much of the swimming season if recommended temperatures are maintained. Solar panels and pool covers qualify for funding. Combining both is recommended. Back-up gas heating is also recommended for cloudy days. This work is recommended as a Low Cost project.

- ECM-24: Use excess summer steam from boilers in Buildings 286, 612, 1628, 1941 and 4332 to drive turbine/generators for electric demand sharing.

Preliminary investigation indicates this ECM is not feasible, due to the lack of sufficient excess steam to drive a turbine generator of significant capacity. This project is not recommended.

- ECM-25: Use wood from existing forestry operations as fuel for steam/electric generation.

This study makes use of waste products (wood chips) as an alternate fuel to replace future coal, which is planned as fuel for a large boiler operation.

This study indicates that once the coal boiler operation is in place, wood chips and the related equipment could be recommended as an alternate fuel system, indicating SIR = 4.43. This would be a P.I.F. project.

- ECM-26: Use groundwater for condensers of chillers in Buildings 286, 1172, 1628, 1941 and 2271.

High costs of drilling water wells of sufficient capacity to meet these requirements yield a SIR of .03. This project is not recommended.

- ECM-27: Install solar screen over quanset huts used for Flight Trainer and Simulators.

The analysis indicates a SIR of 0.25, therefore the work is not recommended.

ECM-28: Combination of data from ECM-5 Building 1733 and ECM-15 Building 7679.

This study looked at the work on two buildings as one project. If accepted both together qualify as a QRIP. Taken as individual projects, B-1733 qualifies a QRIP, but B-7699 qualifies as Low Cost.

4.0 ENERGY COST AND SAVINGS

4.1 Basewide Consumption After ECIP Implementation

While it is somewhat difficult to predict the actual Fort Polk energy consumption in the future due to the ongoing and future growth, it is clear that its energy usage will increase. This increase is not due to poor energy use practices, but from increased square footage and the increased use of air conditioning. Even on a per square foot basis the amount of energy use at Fort Polk has increased since FY-75. This is due to the increased use of electricity for air conditioning in new structures. Natural gas consumption has actually decreased since newer construction is better insulated. Fort Polk's use of energy today is not simply related to increased use or square footage, but to a distinct change in the building stock and interior conditions in the new buildings.

If all other things were held static, the implementation of the recommended Increment "F" ECM's would result in a reduction of FY-83 gas and electric use. Refer to Table ES-8 below.

As mentioned earlier, it is difficult to forecast the future energy use at Fort Polk. What is clear is that as new construction continues, energy use will increase. Fort Polk is in a unique position since virtually the entire post is being rebuilt with new, modern structures. The opportunity to include energy conserving concepts into the designs should not be ignored. Much more energy can be saved if such concepts are part of the original building design rather than added after construction is complete.

TABLE ES-8 OVERALL ENERGY CONSUMPTION (SITE)

ITEM	N. GAS MBTU/YR	ELECTRICITY MBTU/YR	TOTAL MBTU/YR
1983 Base Wide Consumption:	642,245	503,000	1,145,245
Increment "F" Savings: (Table ES-6)	50,228	1,918	52,146
Base Consumption With Increment "F" Savings:	592,017	501,082	1,093,099
Percent Reduction, 1983 Base:	7.8%	0.4%	4.6%

5.0 RESULTS OF INCREMENT "A"

5.1 General

Increment "A" identifies similar groups of buildings that would benefit from various Energy Conservation Measures (ECM's). The large users of energy were identified and studied to determine the most beneficial conservation measure. This basic data was developed for use by other increments.

Twelve ECM's in Increment "A" were analyzed and identified as meeting ECIP criteria. Four of these ECM's were previously combined into one ECIP which has been funded and designed.

5.2 Savings

Implementation of the ECIP's will yield a total natural gas savings of 49,272 MBTU/YR, a total fuel oil savings of 7,811 MBTU/YR, and a total source electricity savings of 45,730 MBTU/YR.

The total FY-86 cost including retrofit contingencies and supervision for implementation of these ECIP's is \$1,703,062. Three ECM's were combined into the "Load Reducing Projects For Non-Family Housing", two ECM's were combined into the "Boiler Alterations" ECIP, and two ECM's were combined into a "Controls For Family Housing" ECIP. The ECIP projects are summarized in Table ES-9.

TABLE ES-9 ECIP ENERGY SAVINGS SUMMARY

ECIP	---Energy Savings (MBTU/YR)---				Const. Cost (FY84 \$)	Total Net Discounted Savings (\$)	SIR
	Nat Gas	Electric	Diesel	Total			
Load Reducing Projects For Non-Family Housing T-100	33,521	12,518	---	46,039	570,904	2,219,262	3.54
Boiler Alterations T-102	14,945	---	7,811	22,756	284,595	881,762	3.77
Controls For Family Housing PECIP T-101	806	11,174	---	11,980	326,924	609,530	1.70
TOTALS	49,272	23,692	7,811	80,775	1,182,423	3,710,554	XXXX

5.3 Non-ECIP's

ECM's investigated in Increment "A" which did not meet ECIP criteria are:

- * Domestic Hot Water Tank Insulation
- * Replace Heating Systems in North Fort Barracks
- * Storm Windows for Family Housing
- * Solar Domestic Hot Water for Residences
- * Electronic Furnace Ignition
- * Floor Insulation
- * Wall Insulation
- * Roof Insulation
- * Energy Conserving Project for New Family Housing
 - Automatic Setback Thermostats
 - Water Heater Insulating Jackets

6.0 Results of Increment "F"

Increment "F" identified specific Energy Conservation Measures that fall into the Low Cost/No Cost conservation measure category. Evaluation data was drawn from previous Increments and applied to the specific ECM's studied. In addition, interviews of Fort Polk staff were conducted and field surveys made to determine additional ECM's for analysis. The field survey concentrated on types of facilities rather than specific buildings.

Specific ECM's studied are presented in Section 3.0. If all recommended ECM's are implemented Fort Polk would save 197,239 dollars per year (1986) and 52,146 MBTU/YR. All qualified projects are recommended for installation.